Lithium ion battery degradation: what you need to know.

Year: 2021 | Citations: 588 | Authors: J. Edge, S. O’Kane, R. Prosser, Niall Kirkaldy, Anisha N. Patel

---

Abstract

The expansion of lithium-ion batteries from consumer electronics to larger-scale transport and energy storage applications has made understanding the many mechanisms responsible for battery degradation increasingly important. The literature in this complex topic has grown considerably; this perspective aims to distil current knowledge into a succinct form, as a reference and a guide to understanding battery degradation. Unlike other reviews, this work emphasises the coupling between the different mechanisms and the different physical and chemical approaches used to trigger, identify and monitor various mechanisms, as well as the various computational models that attempt to simulate these interactions. Degradation is separated into three levels: the actual mechanisms themselves, the observable consequences at cell level called modes and the operational effects such as capacity or power fade. Five principal and thirteen secondary mechanisms were found that are generally considered to be the cause of degradation during normal operation, which all give rise to five observable modes. A flowchart illustrates the different feedback loops that couple the various forms of degradation, whilst a table is presented to highlight the experimental conditions that are most likely to trigger specific degradation mechanisms. Together, they provide a powerful guide to designing experiments or models for investigating battery degradation.